AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. – 10. (Canceled without prejudice or disclaimer)

11. (Previously Presented) A direct-conversion transmitting circuit, characterized by a local modulation circuit comprising first and second mixers, and first and second low-pass filters, first and second gain/bias adjustment means, and a first phase shifter,

wherein high frequency output terminals of said first and second mixers are connected to each other; an output terminal of said first low-pass filter is connected to an input terminal of said first mixer; the input terminal of said first low-pass filter is directly connected to an output terminal of said first gain/bias adjustment means; the output terminal of the second low-pass filter is connected to an input terminal of the second mixer; the input terminal of the second low-pass filter is directly connected to an output terminal of said second gain/bias adjustment means; a first output terminal of said first phase shifter is connected to a local signal input terminal of said first mixer; a second output terminal of said first phase shifter is connected to a local signal input terminal of said second mixer; and input signals are applied to an input terminal of said first gain/bias adjustment means and an input terminal of said second gain/bias adjustment means, respectively,

wherein each circuit of said first and second low-pass filters is composed of a filter whose order is at least a second order, and

wherein said first and second low-pass filter circuits are each composed of a Sallen-Key type filter circuit,

the Sallen-Key type filter is composed of first and second resistors, first and second capacitors, and a first transistor, and a first terminal of said first resistor is an input of the filter; a second terminal of said first resistor is connected to a first terminal of said second resistor; a second terminal of said second resistor is connected to a base of the first transistor; a first terminal of said first capacitor is connected to the second terminal of said first resistor; a second terminal of said first capacitor is connected to an emitter of said first transistor; a first terminal of said second capacitor is connected to the second terminal of said second resistor; a second terminal of said second capacitor is connected to a grounding potential; a collector of said first transistor is connected to a power source potential; and an emitter of said first transistor is an output terminal of the filter.

12. (Previously Presented) A direct-conversion transmitting circuit, characterized by a local modulation circuit comprising first and second mixers, and first and second low-pass filters, first and second gain/bias adjustment means, and a first phase shifter,

wherein high frequency output terminals of said first and second mixers are connected to each other; an output terminal of said first low-pass filter is connected to an input terminal of said first mixer; the input terminal of said first low-pass filter is directly connected to an output terminal of said first gain/bias adjustment means; the output terminal of the second low-pass filter is connected to an input terminal of the second mixer; the input terminal of the second low-pass filter is directly connected to

an output terminal of said second gain/bias adjustment means; a first output terminal of said first phase shifter is connected to a local signal input terminal of said first mixer; a second output terminal of said first phase shifter is connected to a local signal input terminal of said second mixer; and input signals are applied to an input terminal of said first gain/bias adjustment means and an input terminal of said second gain/bias adjustment means, respectively,

wherein each circuit of said first and second low-pass filters is composed of a filter whose order is at least a second order, and

wherein each of said first and second low-pass filter circuits is composed of two sets of first and second Sallen-Key type filter circuits,

said first and second Sallen-Key type filter circuits are each composed of a first, second, third, and fourth resistors, a first and second capacitors, and a first and second transistors,

a first terminal of said first resistor is an input terminal of said filter circuit; a second terminal of said first resistor is connected to a first terminal of said second resistor; a second terminal of said second resistor is connected to a base of said first transistor; a first terminal of said first capacitor is connected to the second terminal of said first resistor; a second terminal of said first capacitor is connected to an emitter of said first transistor; a first terminal of said second capacitor is connected to the second terminal of said second resistor; a second terminal of said second capacitor is connected to a grounding potential; a collector of said first transistor is an output terminal of said filter circuit; a first terminal of said third resistor is connected to the emitter of said first transistor; a second terminal of said third resistor is connected to a grounding potential; a collector and a base of said second transistor are connected

to the first terminal of the first resistor; a first terminal of said fourth resistor is connected to an emitter terminal of said second transistor; and a second terminal of said fourth resistor is connected to a grounding potential,

each of said first and second gain/bias adjustment means is composed of: a first differential pair serving as a voltage/current converter circuit that converts a differential voltage into a differential current; and a second and third differential pairs comprising a first and second collector output terminals, a first and second base input terminals, and an emitter coupling input terminal, and

a first collector output terminal of said first differential pair is connected to said input terminal of said first Sallen-Key filter circuit; a second collector output terminal of said first differential pair is connected to an input terminal of said second Sallen-Key filter circuit; an output terminal of said first Sallen-Key filter circuit is connected to an emitter coupling input terminal of said second differential pair; an output terminal of said second Sallen-Key filter circuit is connected to an emitter coupling input terminal of said third differential pair; first collector output terminals of said second and third differential pairs are connected to each other; second collector output terminals of said second and third differential pairs are connected to each other; a second base input terminal of said third differential pair is connected to a first base input terminal of said second differential pairs; and a first base input terminal of said third differential pair is connected to a second base input terminal of said second differential pair.

13. (Previously Presented) A direct-conversion transmitting circuit, characterized by a local modulation circuit comprising first and second mixers,

and first and second low-pass filters, first and second gain/bias adjustment means, anda first phase shifter,

wherein high frequency output terminals of said first and second mixers are connected to each other; an output terminal of said first low-pass filter is connected to an input terminal of said first mixer; the input terminal of said first low-pass filter is directly connected to an output terminal of said first gain/bias adjustment means; the output terminal of the second low-pass filter is connected to an input terminal of the second mixer; the input terminal of the second low-pass filter is directly connected to an output terminal of said second gain/bias adjustment means; a first output terminal of said first phase shifter is connected to a local signal input terminal of said first mixer; a second output terminal of said first phase shifter is connected to a local signal input terminal of said second mixer; and input signals are applied to an input terminal of said first gain/bias adjustment means and an input terminal of said second gain/bias adjustment means, respectively, and

wherein said first and second mixers are each composed of a differential circuit, and input terminal pairs of said first and second mixers are provided with a first and second DC offset correction circuits to which output terminal pairs are connected,

each of said first and second DC offset correction circuits is composed of a control means having a DA converter, an AD converter, and two outputs,

one output of said control means is connected to an input terminal of said DA converter; the other output of said control means is connected to an input terminal of said AD converter; respective output pairs of said DA converter and said AD converter are connected to each other and thereby are said output terminal pairs,

and

the control means operates said DA converter before the direct-conversion transmitting circuit generates a signal, converts the signal to a logical signal in accordance with a magnitude of a DC component generated at each input terminal of said first and second mixers, and has a function of generating, from said AD converter, a DC level for offsetting the DC component on the basis of a value of the logical signal and a function of storing an optimal level converted into said logical signal.

14. (Previously Presented) A direct-conversion transmitting circuit,

characterized by a local modulation circuit comprising first and second mixers, and first and second low-pass filters, first and second gain/bias adjustment means, and a first phase shifter,

wherein high frequency output terminals of said first and second mixers are connected to each other; an output terminal of said first low-pass filter is connected to an input terminal of said first mixer; the input terminal of said first low-pass filter is directly connected to an output terminal of said first gain/bias adjustment means; the output terminal of the second low-pass filter is connected to an input terminal of the second mixer; the input terminal of the second low-pass filter is directly connected to an output terminal of said second gain/bias adjustment means; a first output terminal of said first phase shifter is connected to a local signal input terminal of said first mixer; a second output terminal of said first phase shifter is connected to a local signal input terminal of said second mixer; and input signals are applied to an input

terminal of said first gain/bias adjustment means and an input terminal of said second gain/bias adjustment means, respectively, and

wherein the direct-conversion transmitting circuit is composed of: a first and second control means each having a first and second DA converters, an AD converter, and two outputs; a DC offset correction circuit having a first, second, third and fourth output terminals pairs; and further a switching means having two sets of output terminal pairs,

an output of said first control means is connected to an input of said first DA converter; an output of said second control means is connected to an input of said second DA converter; an output pair of said first DA converter is connected to a first output terminal pair of said DC offset correction circuit; an output pair of said second DA converter is connected to a second output terminal pair of said DC offset correction circuit; and an output of said AD converter is connected to a third output terminal pair of said DC offset correction circuit,

said first and second mixers each are composed of a differential circuit, in which the first output terminal pair of said DC offset correction circuit is connected to an input terminal pair of said first mixer; the second output terminal pair of said DC offset correction circuit is connected to an input terminal pair of said second mixer; and the third output pair of said DC offset correction circuit is connected to an input terminal pair of said switching means,

one output terminal pair of said switching means is connected to the input terminal pair of said first mixer; and the other output terminal pair of said switching means is connected to the input terminal pair of said second mixer, and

each of said first and second control means operates said first and second DA

converters before the direct-conversion transmitting circuit generates a signal, and converts the signal to a logical signal based on magnitude of a DC component generated at input terminals of said first and second mixers, and has a function of switching said switching means such that a DC level generated by said AD converters is applied to the input terminal pairs of said first and second mixers at a different period in order to offset a DC component generated at each of the input terminal pairs of said first and second mixers in accordance with a value of the logic signal, and a function of storing an optical level converted into said logical signal.

15. (New) A direct-conversion transmitting circuit comprising:

first and second mixers;

first and second low-pass filters;

first and second gain/bias adjusters; and

a first phase shifter,

wherein high frequency output terminals of said first and second mixers are connected to each other,

wherein an output terminal of said first low-pass filter is directly connected to an input terminal of said first mixer, and an input terminal of said first low-pass filter is connected to an output terminal of said first gain/bias adjuster to suppress a noise generated by said first gain/bias adjuster,

wherein an output terminal of said second low-pass filter is directly connected to an input terminal of said second mixer, and an input terminal of said second low-pass filter is connected to an output terminal of said second gain/bias adjuster to suppress a noise generated by said second gain/bias adjuster,

wherein a first output terminal of said first phase shifter is connected to a local signal input terminal of said first mixer, and a second output terminal of said first phase shifter is connected to a local signal input terminal of said second mixer,

wherein an input signal generated from an output signal of a first AD converter is applied to an input terminal of said second gain/bias adjuster to reduce difference in gain and bias levels between an input signal of said first mixer and an output signal of said first AD signal of said first AD converter, and

wherein an input signal generated from an output signal of a second AD converter is applied to an input terminal of said second gain/bias adjuster to reduce difference in gain and bias levels between an input signal of said second mixer and an output signal of said second AD converter.

16. (New) The direct-conversion transmitting circuit according to claim 15, wherein said first phase shifter comprises a frequency divider circuit.

17. (New) The direct-conversion transmitting circuit according to claim 15, wherein each of said first and second low-pass filters comprises a filter circuit whose order is at least a second order.

18. (New) The direct-conversion transmitting circuit according to claim 17,

wherein each of said first and second low-pass filter circuits comprises a Sallen-Key type filter circuit, said Sallen-Key type filter circuit includes first and second resistors, first and second capacitors, and a first transistor,

a first terminal of said first resistor acts as an input of the filter, a second terminal of said first resistor is connected to a first terminal of said second resistor, a second terminal of said second resistor is connected to a base of the first transistor, a first terminal of said first capacitor is connected to the second terminal of said first resistor, a second terminal of said first capacitor is connected to an emitter of said first transistor, a first terminal of said second capacitor is connected to the second terminal of said second resistor, a second terminal of said capacitor is connected to a grounding potential, a collector of said first transistor is connected to a power source potential and an emitter of said first transistor acts as an output terminal of the filter.

19. (New) The direct-conversion transmitting circuit according to claim 17,

wherein each of said first and second low-pass filter circuits comprises first and second Sallen-Key type filter circuits, each of said first and second Sallen-Key type filter circuits includes first, second, third, and fourth resistors, first and second capacitors, and first and second transistors,

a first terminal of said first resistor acts as an input terminal of said filter circuit, a second terminal of said first resistor is connected to a first terminal of said second resistor, a second terminal of said second resistor is connected to a base of said first transistor, a first terminal of said first capacitor is connected to the second

terminal of said first resistor, a second terminal of said first capacitor is connected to an emitter of said first transistor, a first terminal of said second capacitor is connected to the second terminal of said second resistor, a second terminal of said second capacitor is connected to a grounding potential, a collector of said first transistor acts as an output terminal of said filter circuit, a first terminal of said third resistor is connected to the emitter of said first transistor, a second terminal of said third resistor is connected to a grounding potential, a collector and a base of said second transistor are connected to the first terminal of the first resistor, a first terminal of said fourth resistor is connected to an emitter terminal of said second transistor and a second terminal of said fourth resistor is connected to a grounding potential;

wherein each of said first and second gain/bias adjusters comprises a first differential transistor pair serving as a voltage/current converter circuit that converts a differential voltage into a differential current,

a first collector output terminal of said first differential transistor pair is connected to the input terminal of said first Sallen-Key filter circuit and a second collector output terminal of said first differential transistor pair is connected to the input terminal of said second Sallen-Key filter circuit; and

wherein each of said first and second mixers comprises second and third differential transistor pairs comprising first and second collector output terminals, first and second base input terminals, and an emitter coupling input terminal,

an output terminal of said first Sallen-Key filter circuit is connected to an emitter coupling input terminal of said second differential transistor pair and an output terminal of said second Sallen-Key filter circuit is connected to an emitter

coupling input terminal of said third differential transistor pair, first collector output terminals of said second and third differential transistor pairs are connected to each other, second collector output terminals of said second and third differential transistor pairs are connected to each other, a second base input terminal of said third differential transistor pair is connected to a first base input terminal of said second differential transistor pairs, and a first base input terminal of said third differential transistor pair is connected to a second base input terminal of said second differential transistor pair.

20. (New) The direct-conversion transmitting circuit according to claim 15, wherein each of said first and second mixers comprises a differential circuit, and the direct-conversion transmitting circuit further comprises:

first and second DC offset correction circuits each of which is coupled, via a pair of output terminals thereof, to a pair of input terminals of a corresponding one of said first and second mixers each of said first and second DC offset correction circuits includes a control means, a DA converter, an AD converter, and a pair of output terminals,

wherein at each DC offset correction circuit an output of said control means is connected to an input terminal of said DA converter, another output of said control means is connected to an input terminal of said AD converter, respective output pairs of said DA converter and said AD converter are connected to each other and represent the output terminal pair of that DC correction circuit, and

wherein each control means operates the corresponding said DA converter before the direct-conversion transmitting circuit generates a signal, converts the signal to a logical signal in accordance with a magnitude of a DC component generated at each input terminal of the corresponding one said first and second mixers, and has a function of generating, from the corresponding said AD converter, a DC level for offsetting the DC component on the basis of a value of the logical signal and a function of storing an optimal level converted into said logical signal.

21. (New) The direct-conversion transmitting circuit according to claim 15, further comprising first and second control means, first and second (DA) converters, a further (AD) converter, and two outputs; a DC offset correction circuit having first, second, third and fourth output terminals pairs; and further a switching means having two sets of output terminal pairs, wherein:

an output of said first control means is connected to an input of said first DA converter; and output of said second control means is connected to an input of said second DA converter; an output pair of said first DA converter is connected to a first output terminal pair of said DC offset correction circuit; an output pair of said second DA converter is connected to a second output terminal pair of said DC offset correction circuit; and an output of said further AD converter is connected to a third output terminal pair of said DC offset correction circuit,

said first and second mixers are each comprised of a differential circuit, in which the first output terminal pair of said DC offset correction circuit is connected to an input terminal pair of said first mixer; the second output terminal pair of said DC offset correction circuit is connected to an input terminal pair of said second mixer;

and the third output pair of said DC Offset correction circuit is connected to an input terminal pair of said switching means,

one output terminal pair of said switching means is connected to the input terminal pair of said first mixer; and the other output terminal pair of said switching means is connected to the input terminal pair of said second mixer, and

each of said first and second control means operates said first and second DA converters before the direct-conversion transmitting circuit generates a signal, and converts the signal to a logical signal based on magnitude of a DC component generated at input terminals of said first and second mixers, and has a function of switching said switching means such that a DC level generated by said AD converters is applied to the input terminal pairs of said first and second mixers at a different period in order to offset a DC component generated at each of the input terminal pairs of said first and second mixers in accordance with a value of the logic signal, and a function of storing an optical level converted into said logical signal.

22. (New) A integrated transmitting/receiving circuit including a transmitting section and a receiving section which are integrated on the same chip, wherein the transmitting section comprises a first direct-conversion transmitting circuit using the direct-conversion transmitting circuit according to claim 15, and third and fourth amplifiers, and wherein the receiving section comprises first to third low noise amplifiers, third and fourth mixers, a first to third frequency dividers, a first frequency synthesizer, a first voltage control type oscillator, and first and second baseband frequency amplifiers/filter rows,

wherein an output of said first direct-conversion transmitting circuit is connected to respective input circuits of said third and fourth amplifiers; said third and fourth amplifiers are used as independent output terminals; output terminals of said first to third low noise amplifiers are connected to one another to connect inputs of said third and fourth mixers; outputs of said third and fourth mixers are connected to said first and second baseband frequency amplifiers/filter rows; a first output of said first frequency divider is connected to a local signal input terminal of said third mixer; a second output of said first frequency divider is connected to a local signal input terminal of said fourth mixer circuit; an output terminal of said first frequency synthesizer is connected to a control voltage input terminal of said first voltage control oscillator; an output of said first voltage control oscillator is connected to an input of said first frequency synthesizer; and output of said first voltage control oscillator is connected to an input terminal of said second frequency divider having two functions of executing and bypassing a frequency dividing function; said second frequency divider is connected to an input of said first frequency divider; an output of said first voltage control oscillator is connected to an input terminal of said third frequency divider having two functions of executing and bypassing a frequency dividing function; said third frequency divider is connected to an input terminal of a first phase shifter in said first direct-conversion transmitting circuit, and said first phase shifter is a frequency shifter.

23. (New) The integrated transmitting/receiving circuit according to claim 22,

wherein a fourth frequency divider is interposed between second and third frequency dividers whose respective input terminals are connected to the input terminal of said first voltage control oscillator.

24. (New) The integrated transmitting/receiving circuit according to claim 23, wherein said fourth frequency divider has two functions of executing and bypassing a frequency dividing function, and

a fourth low noise amplifier is further provided which has an input terminal independent from respective input terminals of the other low noise amplifiers and has an output terminal connected to respective output terminals of the other low noise amplifiers.